SECTION X

BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE -- EFFLUENT LIMITATIONS

The application of best available technology economically achievable is being defined as further reductions of water flows in-plant and the addition of a physical - chemical treatment step (activated carbon), end-of-pipe. The limitations, which set numerical values for the allowable pollutant discharges within each subcategory for BATEA are presented in Tables 1-6. Although there are specific systems which can effectively reduce the water usage from a particular process to nearly zero, these "zero discharge" systems cannot be uniformly applied throughout the refinery to develop "zero discharge" criteria for the entire refinery.

BATEA in-plant technology is based on control practices now practiced by some plants in the petroleum refining industry, and include the following:

(1) Use of air cooling equipment.
(2) Reuse of sour water stripper bottoms in crude desalters.
(3) Reuse of once-through cooling water as make-up to the water treatment plant.
(4) Using waste water treatment plant effluent as cooling water, scrubber water, and influent to the water treatment plant.
(5) Reuse of boiler condensate as boiler feedwater.
(6) Recycle of water from coking operations.
(7) Recycle of waste acids from alkylation units.
(8) Recycle of overhead water in water washes.
(9) Reuse overhead accumulator water in desalters.
(10) Use of closed compressor and pump cooling water system.
(11) Reuse of heated water from the vacuum overhead condensers to heat the crude. This reduces the amount of cooling water needed.
(12) Use of rain runoff as cooling tower make-up or water treatment plant feed.
(13) Other methods.

Flow

Flow reductions proposed for BATEA effluent limitations were derived from further analysis of the 1972 National Petroleum Waste Water Characterization Studies. The flows from refineries in each subcategory meeting the BPCTCA flow basis were averaged to determine the flow basis for establishment of BATEA effluent limitations. That these average flows are achievable within the petroleum refining industry is readily demonstrable, by determining the number and geographical distribution of refineries in the United States currently at, or lower than, the proposed BATEA flows. There are 3 to 5 refineries in each of the five subcategories which have flows less than or equal to the proposed BATEA effluent limitations. These refineries range in size from 827,000 to 69,000,000 cubic meters per stream day (5,200 to 434,000 barrels per stream day), and range in cracking capacity from 0 to 106 percent. The geographical distribution of these refineries indicates that good water practices, and consequently low waste water flows, are not confined to water - short areas or cool climates, but are located throughout the United States. Within this group of refineries with low-water usage, there are refineries located in both high rainfall and dry areas (Washington and New Mexico) and areas of extreme temperatures (New Mexico and Texas to Alaska and Minnesota).

Consequently, these flows, shown in Table 52, were used as the basis for establishment of BATEA effluent limitations. The objective of this basis for flow is to provide inducement for in-plant reduction of both flow and contaminant loadings prior to end-of-pipe treatment. However, it is not the intent of these effluent limitations to specify either the unit waste water flow which must be achieved or the waste water treatment practices which must be employed at the individual petroleum refinery.

The end-of-pipe system proposed for BATEA technology is based on the addition of activated carbon adsorption in fixed bed columns, to the treatment system proposed as BPCTCA technology.

Procedure for Development of BATEA Effluent Limitations

The effluent limitations proposed for BATEA technology are based on refinery pilot plant data, which indicate the percentage reductions achievable or concentrations achievable for effluents from activated carbon adsorption systems. These data are presented in Table 53.

These concentrations were then used in conjunction with the BATEA flows from Table 53 or the percentage reductions were applied to the BPCTCA effluent limit. The daily annual average effluent limitations determined are contained in Table 54.

Since these effluent limitations are based upon pilot plant data, which have not been fully demonstrated in full-scale installations as actual performance data becomes available, the effluent limitations presented in Tables 1-6 may require revision.

Variability Allowance for Treatment Plant Performance

The effluent limitations presented in Tables 1-6 have taken into consideration the variability factors, as in BPCTCA. Since there is not enough performance data from physical - chemical treatment systems available at this time to determine variability, the ratios established for BPCTCA at the 98% confidence level have been used. (See Table 55).

TABLE 52

FLOW BASIS FOR DEVELOPING

BATEA EFFLUENT LIMITATIONS

Subcategory	Flow, per unit throughout	
	M3/M3	Gallons/BBL
Topping	0.255	10.5
Cracking	0.33	14
Petrochemical	0.46	19
Lube	0.73	30.5
Integrated	0.88	36.5

TABLE 53

BATEA REDUCTIONS IN POLLUTANT LOADS ACHIEVABLE BY APPLICATION OF ACTIVATED CARBON TO MEDIA FILTRATION EFFLUENT BPCTCA

Parameter	Type of Data	Achievable Refinery Effluent mg/L	Achievable Refinery Effluent % Reduction	References
BOD	Pilot Plant	5	-	21,27,31A,48,62A
COD	Pilot Plant	-	75	21,27,31A,47,53,62A
TOC	Pilot Plant	15	-	17,31A,48,62A
TSS	Pilot Plant	5	-	31A,48,53,62A
Oil	Pilot Plant	1-1.7	80	31A,48,62A
Phenols	Pilot Plant	0.02	99	31A,48,62A
Ammonia	Pilot Plant	-	60	27,31A,62A
Sulfides	No data	-	-	

TABLE 54
BATEA

Annual Average Daily Kilograms of Pollutants/1000 Cubic Meters of Feedstock (1) Per Stream Day
(Annual Average Daily Pounds of Pollutants/1000 BBL of Feedstock Per Stream Day)

Refinery Subcategory	BOD5	COD	TOC	Total Suspended Solids	Oil & Grease	Phenolic Compounds	Ammonia(N)	Sulfide	Total Chromium	Hexavalent Chromium
Topping	1.2(0.44)	5.0(1.75)	3.7(1.3)	1.2(0.44)	0.25(0.088)	0.0051(0.0018)	0.34(0.12)	0.025(0.0087)	0.062(0.022)	0.0012(0.00044)
Cracking	1.6(0.58)	9.6(3.4)	5.0(1.75)	1.6(0.58)	0.34(0.12)	0.0065(0.0023)	2.3 (0.8)	0.034(0.012)	0.082(0.029)	0.0016(0.00058)
Petrochemical	2.2(0.79)	10.8(3.8)	6.8(2.4)	2.2(0.79)	0.45(0.16)	0.0091(0.0032)	2.8 (1.0)	0.045(0.016)	0.11 (0.040)	0.0022(0.00079)
Lube	3.7(1.3)	20.0(6.9)	10.8(3.8)	3.7(1.3)	0.71(0.25)	0.014 (0.0051)	2.8 (1.0)	0.071(0.025)	0.18 (0.063)	0.0037(0.0013)
Integrated	4.2(1.5)	23.7(8.4)	13.0(4.6)	4.2(1.5)	0.85(0.30)	0.017 (0.0061)	2.8 (1.0)	0.085(0.030)	0.22(0.076)	0.0042(0.0015)
Runoff(2)	0.0050(0.042)	0.014(0.12)	0.016(0.13)	0.0050(0.042)	0.0010(0.009)	--	--	--	--	--
Ballast (3)	0.0050(0.042)	0.019(0.16)	0.016(0.13)	0.0050(0.042)	0.0010(0.009)	--	--	--	--	--

(1) Feedstock - Crude oil and/or natural gas liquids.
(2) The additional allocation being allowed for contaminated storm runoff flow, kg/1000 (lb/1000 gallons), shall be based solely on that storm flow which passes through the treatment system. All additional storm runoff, that has been segregated from the main waste stream, shall not exceed a TOC concentration of 35 mg/l or Oil & Grease concentration of 15 mg/l when discharged.
(3) This is an additional allocation, based on ballast water intake - kilograms per 1000 liters (pounds per 1000 gallons).

TABLE 55

VARIABILITY FACTORS BASED ON PROPERLY DESIGNED AND OPERATED WASTE TREATMENT FACILITIES-BATEA

	BOD_5	COD	TOC	TSS	O & G	Phenol	Ammonia	Sulfide	CrT	Cr6
Daily Variability	2.1	2.0	1.6	2.0	2.0	2.4	2.0	2.2	2.0	2.2
30-day Variability	1.7	1.6	1.3	1.7	1.6	1.7	1.5	1.4	1.7	1.4